

FIRE.GOV

Better fire fighting through research

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Page 1

Protecting Crews During
Wildfires

Sprinkler Tests in
Dormitories

Page 2

Are U.S. Fire Hydrants
Standardized?

Roof Sprinklers Protect
Homes from Wildfires

Page 3

Predicting Risk at the
Wildland-Urban
Interface

Page 4

Aerial Wildfire
Suppression... How
Good Is It?

First Editor of **Fire.Gov**
Says Farewell

Protecting Crews During Wildfires

How can the vehicles used in wildfires better protect the firefighters that use them? Indeed, this is a perplexing problem. Thousands of wildland firefighters each year face severe wildfire environments that include smoke, noise and chemical conditions, as well as physiological and psychological stress for the firefighter.

To address this question, and to develop vehicle crew protection systems for the safety of firefighters during wildfire suppression, Dave Nichols and his CFA (County Fire Authority), Melbourne, Victoria, Australia, and the New South Wales Rural Fire Service (RFS) commissioned CSIRO (Commonwealth Scientific and Industrial Research Organization) scientists to evaluate fire tanker vehicle crew protection during burnover using a large gas-fired wildfire burnover simulator.

The evaluation resulted in the development and implementation of a prototype vehicle crew protection system involving radiant heat curtains and water spray systems.

Next, the Bushfire Cooperation Research Centre (CRC) scientists joined CFA, RFS and CSIRO in conducting two large scale fire tests in Tumbatumba, New South Wales, to validate the vehicle crew protection system findings from the wildfire burner simulator tests.

The burnover simulator fire tests subjected the vehicle crew protection systems to multiple levels of temperatures and fire durations simulating low to moderate fire line intensity fires from 2.5 MW/m to 10 MW/m. The fire tests provided results for two levels of radiant temperature and flame duration exposure on the prototype crew protection system in the controlled wildfire.

Some of the conclusions were: Radiant heat curtains are effective in reducing inside cabin and crew radiant heat and high temperatures; well designed water spray systems will provide useful gains in firefighter safety in moderate wildfire intensity.

A report on this study, "Hazards in the Workplace—Fire Crew Protection", was presented at the 1st Bushfire CRC Conference. For more information, contact Dave Nichols by e-mail at d.nichols@cfa.vic.gov.au.



Burnover Simulator Fire Tests Crew Protection Systems.

Sprinkler Tests in Dormitories

Many parents worry about their children's safety when they leave home to pursue an education. In fact, in the United States each year about 1,300 fires occur in school and college dormitories and a majority of these buildings do not have sprinklers. How fire safe are the dormitories where many students live? To address this question, the U.S. Fire Administration (USFA) has an initiative to improve fire safety in college housing. As part of the

initiative, the National Institute of Standards and Technology (NIST) conducted two series of full-scale fire tests in abandoned dormitory buildings.

The objective of the study was to compare the levels of hazard created by room fires in a dormitory building with and without automatic fire sprinklers in the room of fire origin.



Room Fire Experiments Demonstrate Impact of Automatic Sprinklers.

Cont. on page 2

Sprinkler Tests in Dormitories, cont.



Still Image Captured from the Dormitory Test Video

A series of experiments initiated in a day room open to the corridor of the dormitory were conducted as part of the study. Smoke alarm and sprinkler activation are presented for all three tests. Quantitative measurements were made for heat only, and some qualitative measurements were made for visibility with video cameras.

The experiments demonstrate the significant improvements in life safety that an automatic sprinkler system can provide. The recommended thermal tenability levels of

120°C (250°F) for temperature and 2.5 kW/m² for heat flux (from the *SFPE Handbook of Fire Protection Engineering*) were used to compare the data. In the unsprinklered experiments, the temperature tenability limits were exceeded in the corridor remote from the fire. Untenable conditions began in the corridor as early as 3 minutes after ignition and spread through the corridor within another 3 minutes. In the sprinklered experiments at no time did the temperature in the day room or in the corridor exceed 120°C (250°F) at the

1.5 m (5 ft) level above the floor and below.

No significant increase in the heat flux above ambient conditions was measured in the corridor.

The complete report, "Impact of Sprinklers on the Fire Hazard in Dormitories: Day Room Fire Experiments", NISTIR 7120, by D. Madrzykowski, D. Stroup, and W. D. Walton is available here, or a copy in CD format may be obtained by contacting Dave Stroup, david.stroup@nist.gov.

Are U.S. Fire Hydrants Standardized?



Momar Seck and NIST firefighter Ivan Todd confirm that both connections on this NIST Gaithersburg site fire hydrant comply with the national standard.

One hundred years have passed since the Great Baltimore (Maryland, USA) Fire started on February 7, 1904. It is believed the fire started by a cigar or cigarette that fell into the basement of a building. It took thirty hours to put out the fire because of fire hydrant and hose connection incompatibility, despite efforts from fire departments from as far away as New York City. 1,231 firefighters, 57 engines, nine trucks, two hose companies, one fireboat and one police boat were involved in the suppression effort. The fire claimed 1,526 buildings in an area of 70 city blocks. Shortly thereafter, a national standard for fire hydrant connections was adopted by the

National Fire Protection Association.

How compatible are the hydrant and hose connections today? Today, fire engines are forced to carry adaptors that can make connections with all hydrants in their local areas. A recent report, "Major U.S. Cities Using National Standard Fire Hydrants, One Century After the Great Baltimore Fire", NISTIR 7158, by Momar D. Seck and David D. Evans, addresses that question. Survey results from the 48 largest cities in the United States are summarized in the report.

For more information, contact Nelson Bryner at 301-975-6868 or nelson.bryner@nist.gov.

Roof Sprinklers Protect Homes from Wildfires

Throughout the world, the wildland fire season appears to be expanding and presenting new challenges. People are building in, or closer to, forests or they landscape their properties to resemble small forests.

In the event of a forest fire, firebrands and high winds often make an unfortunate combination in these situations. However, one approach to the problem has been developed by the South Australian County Fire Service.

The SA County Fire Service has tested a sprinkler system on metal or tile roofs and they appear to be quite effective in protecting the home by reducing the impact of radiant heat, direct flame contact and

ember attack on the home by supplying a curtain of water that wets down the roof and walls.

Cont. on page 3

Roof Sprinklers Project Homes from Wildfires, cont.

There are many important questions that a homeowner must address to determine if installing this potential safeguard is the appropriate course of action. Three points to consider before installing a sprinkler system are: Are you sure that someone will be home to turn the sprinklers on in the event of a wildfire? Do you have sufficient water to enable a sprinkler system to operate for two to three hours? Is a means of providing adequate water pressure needed in order to operate the system?

These questions, among others, are discussed in the brochure, "Wildfire Fact Sheet, No.11—Community Fire Safety, Sprinkler Systems." Some other questions asked are: "Is your home constructed from flammable material such as vinyl weatherboards or timber?" and "Does your home have poorly fitting tiles or metal sheets on the roof?"

To learn more about the tests, Wildfire Fact Sheet No. 11 can be downloaded from the CFS web site,

<http://www.cfs.org.au/protect/factsheets.asp> and click on "Sprinkler Systems." or contact Brian Menadue. Brian has been leading this research effort and he may be reached via e-mail at menadue.brian@cfs.org.au.



Roof Sprinkler System



Wildfire Fact Sheet No. 11

Predicting Risk at the Wildland-Urban Interface

How can fire modelers best predict what contributions individual elements may add to the overall risk of structural loss in wildland fires?

To address this question, Justin Leonard and his colleagues at CSIRO Manufacturing and Infrastructure Technology in Australia are developing a computer model to predict the risk of destruction of any specific house in the wildland-urban interface. The Australian standard for risk management, AS/NZS 4360 *Risk Management*, has defined risk as the "chance of something happening that will have an impact upon objectives". The standard outlines two main aspects required to define a risk event: impact and susceptibility. These two aspects of the standard are discussed, as well as how they are linked to a physical-based model.

The bushfire impact can be grouped into three categories: flame, radiation, and ember/debris. Each mode of impact has a unique range of properties. It is the authors' opinions that the area impacted by flame attacks is the overriding characteristic for consideration. Flame quality or specific flame temperature variations due to differences in cellulose fuel sources did not appear to warrant quantification for this attack mechanism. To study the radiation impact upon the house, the most appropriate method is to use a time/radiation curve. Embers and windborne debris are the most prevalent attack mechanism on houses in Australian bushfires. When considering how a fire event impacts an urban area

(excluding house-to-house transfer) well over 90% of the houses are ignited by ember attack.

The efforts of many investigations into building impact in bushfire events, combined with the information from extensive laboratory fire testing of materials and systems performance of various building elements, led to the database of known bushfire impacts that was used in the model.

The physical-based model can link defined models of bushfire impact with observed building element performances. The model utilizes a spatial calculation format to determine the probability that ignitions will occur, as well as incorporating the known behavior of associated elements around the structure.

"Access Denied: Protection Buildings from Agents of Fire", a paper presented at the 1st Bushfire CRC Conference in Perth, Australia, October 7-9, 2004, summarizes the work. Additional information about the model may be obtained by contacting Justin via e-mail at Justin.Leonard@csiro.au.



Fire Spread by Burning Embers Included in Risk Prediction Model

Aerial Wildfire Suppression... How Good Is It?

Many countries have used aircraft for wildfire suppression since the mid-20th Century, and in Australia from the 1960s. Fire agencies have used both fixed wing aircraft and helicopters (heavy, medium, light) as part of their wildfire suppression strategy. As wildfires become more common, the use of aircraft has increased, however, it is not known how cost effective they are.

The Bushfire CRC (Cooperative Research Center [Australia]) suppression project is investigating the effectiveness of aerial fire bombing for

suppression of wildfires. The project's objective is to optimize the effectiveness and efficiency of aircraft used during firefighting operations.

The project looks at different techniques that are used for aerial suppression. Three types of suppressants used in fire bombing are water, foam, and retardants. Water and foam solutions are usually dropped directly onto the burning edge of the fire. Retardants are usually dropped ahead of the fire, as they coat and protect the fuel from fire. The effectiveness of a fire bombing drop is related to

the pattern of the drop on the ground and whether this meets the coverage required to extinguish the fire or coat fuel to form an effective firebreak. The effectiveness of a drop pattern can be influenced by the aircraft's speed, height above the ground, wind speed and canopy interception. An effective drop will either extinguish or curtail the fire along the length of the drop.

Jim Gould, from Bushfire CRC, summarized the project in his paper, "Scientific Approach in Assessing Aerial Suppression" which was presented at the

1st Bushfire CRC Conference in Perth, Australia, October 7-9, 2004. For more information, Jim may be reached via e-mail at jim.gould@csiro.au.



Aircraft Dropping Fire Retardant on Wildfire.

First Editor of FIRE.GOV Says Farewell

This electronic newsletter began over three years ago as a result of conversations with fire service leadership who wanted all firefighters to be knowledgeable about research developments that could impact the future of the fire service. It was my pleasure organizing this effort to bring research results and news of research activities that

could contribute to better fire fighting in an attractive and readable format. What we have accomplished is due to the enthusiasm of my partners, Nora Jason and Kellie Beall, and the funding provided by NIST. We have built a registered readership of over 1,700 that continues to grow with each issue.

I thank you all for making this effort a success. With this issue, the responsibilities of Editor have passed to the very capable Nelson Bryner, Leader of the Fire Fighting Technology Group at NIST. I wish Nelson and the FIRE.GOV publication team continued success.

-- Dave Evans

In turn, all of us here at **FIRE.GOV** wish Dave success in his new career as the Executive Director of the Society of Fire Protection Engineers. Thanks Dave, we will miss you!



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